Requirements Management Procedure
OETI-PMP-07

Environmental Protection Agency
Office of Enterprise Technology and Innovation (OETI)

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Document Change History

Version	Date	Author	Description of Changes

Contents

1. Introduction

This document defines the process by which staff within the Environmental Protection Agency (EPA)'s Office of Enterprise Technology and Innovation (OETI) performs requirements management (RM).

1.1   Purpose

This document defines the methodology, process flow, and relevant standards by which OETI project staff performs RM activities and identifies participants and their responsibilities.

1.2   Background

A requirement is defined by the Project Management Institute (PMI) as "a condition or capability that must be met or possessed by a system, product, service, result or component to satisfy a contract, standard, specification or other formally imposed document."[1] Requirements are the desired characteristics of the deliverable being produced, whether it is a system, work product, or service. If defined for a project, requirements form the basis for estimating all project activities, planning and tracking those activities, and creating the work products and services. Requirements include the quantified and documented needs, desires, and expectations of a project's customers and other stakeholders. The RM process involves establishing and maintaining an understanding and agreement between the project team and all relevant customers and stakeholders on the requirements for a project throughout the project life cycle. The agreement includes technical and non-technical requirements and forms the basis for estimating, planning, performing, and tracking the project's activities throughout the project life cycle.

The development of business and functional requirements and RM begin during the planning process of a project as described in *PMP-02 Project Initiation and Planning Procedure* and may be a driver for initiating a new project. Although there is typically a specific requirements analysis phase within a project, requirements are not static; the project team or customer may add, delete, or modify requirements during the execution of the project. Therefore, RM is performed throughout the project life cycle, from initial planning and identification to project close out. While changes to requirements may be made at any point in the project's life cycle, any changes required once they are baselined are managed through the Change Control Process (Refer to *PMP-08 Change Control Procedure* for details on the process).

Business requirements list the features or specifications that the final solution should provide to meet a project's business objectives. Types of business requirements may include but are not limited to the following:

- Functionality
- Usability
- Reliability
- Performance
- Supportability.

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[1] Project Management Institute, The Project Management Body of Knowledge *(PMBOK®)*, Third Edition. 2004 Glossary, p. 371.

Functional requirements should include information necessary to provide a complete representation of the proposed product or service. These requirements could include narrative descriptions, screen layouts, process flows, data flows, etc. Readers of functional requirements should be able to envision how the new process, product, or system will work.

Scope describes the boundaries of the project. It defines what the project will deliver and what it will not deliver. The boundaries of a project may be expressed in some combination of geography, organization, applications, and/or business functions. For larger projects, it can include the organizations affected, the transactions affected, the data types included, etc. The scope of a project may contain many deliverables, each of which may have its own set of requirements.

2. Approach

This section explains the approach used to develop this RM procedure. It details the degree of scalability of this procedure, and the industry standards, best practices, and EPA current practices consulted in creating this procedure.

2.1   Assumptions

The following assumptions guide this RM procedure:

- A Requirements Manager will be appointed by the Project Manager who has familiarity with requirements management practices. Requirements may or may not be the Requirement Manager's only responsibility, depending on the size, scope, and complexity of the project.

- The Requirements Manager will maintain documents using the document management procedures and tools defined for the project. (See *PMP-12 Document Management Procedure.*)

- All OETI information technology (IT) projects are required to use and follow this procedure. In addition, for agency system projects, the Office of Environmental Information (OEI) System Life Cycle Management (SLCM) policy and procedures apply.

- Non-IT projects which require definition and management of requirements may adapt this procedure based on what is described in the scalability section below.

2.2   Scalability

As part of the project initiation and planning activities defined in *PMP-02 Project Initiation and Planning Procedure*, the Project Manager determines whether RM applies to the project and if so, the extent to which the procedure should be implemented. The most significant factor used for determining whether RM applies is whether a distinct set of requirements has been defined for the project's outcome (deliverable, service, or product) by the customer or stakeholders. As detailed in Table 2.1, the extent of RM procedures and the number of resources involved in the RM process is determined by the size and complexity of the project. Therefore, projects with more requirements may require greater management discipline to avoid unplanned scope changes. New or unique projects may also require more effort. The criteria can be adjusted based on the unique project requirements, especially for projects that are smaller or have lower complexity. The project team must evaluate these unique characteristics of the project during the planning process for RM and determine how best to adjust the procedure to address specific project risks and requirements.

Table 2.1. RM Procedure Scalability Guidelines

Procedure	Does the Procedure Apply?	Determining Procedure Scalability
OETI-PMP-07 Requirements Management Procedure	- Applies if project is an IT project - Applies if a set of baseline requirements is defined where traceability is required	- Procedure is scaled based on the type of project, whether the project is new for the organization, the number and type of stakeholders, and whether or not the stakeholders are responsible for defining "what" the project should achieve

This procedure describes the RM process and components of the process, which are flexible and can be modified based on project size and resource constraints. The basic procedure remains the same; however, the resources allocated and the documentation produced may increase or decrease

depending on the project's assigned complexity. The roles and responsibilities may also be modified and be performed by more than one person.

2.3   Best Practices

The OETI vision includes the employment of best practices from both industry and the EPA. This procedure incorporates the following best practices and existing regulations and policies:

- **EPA regulations and standards**
  - EPA Directive 2100.5, System Life Cycle Management Policy. Available at: http://intranet.epa.gov/oei/imitpolicy/qic/ciopolicy/2100.5.pdf
  - The EPA Interim Agency System Life Cycle Management Procedures. Available at: http://intranet.epa.gov/otop/policies/Extended_InterimProcedures.pdf
- **Federal regulations, industry standards, and best practices**
  - Software Engineering Institute (SEI) Capability Maturity Model Integration (CMMI), CMMI for Systems Engineering, Software Engineering, Integrated Product and Process Development, and Supplier Sourcing, Version 1.1, CMMI-SE/SW/IPPD/SS, March 2002.
  - Project Management Institute, The Project Management Body of Knowledge *(PMBOK®)*, Third Edition. 2004.

3. Roles and Responsibilities

Table 3-1 presents the roles and responsibilities for OETI project staff involved in requirements management activities. This table lists functions or tasks that each project role performs. While each role will be assigned to an individual staff member, an individual may perform multiple roles for a project.

Table 3.1. RM Roles and Responsibilities

Role	Responsibilities
Project Manager	▪ Works with the Requirements Manager, stakeholders, and contractors, as necessary, on requirements planning, reviewing, validating, and monitoring ▪ Works with appropriate project stakeholders to define scope of release (for systems projects) ▪ Reviews and approves requirements artifacts ▪ Communicates requirements activities with senior project management ▪ Reviews and confirms requirement changes for scope, cost, and schedule impact as a result of approved Change Control Board (CCB) activities ▪ Evaluates requirement changes for scope impact as part of CCB activities
Project Team Lead	▪ Works with the Requirements Manager, stakeholders, and contractors, as necessary, on requirements planning, reviewing, validating, and monitoring ▪ Reviews requirements documentation and provides comments ▪ Reviews Requirements Traceability Matrix (RTM) and provides comments ▪ Evaluates requirement changes for scope impact as part of CCB activities
Requirements Manager	▪ Participates in capturing, defining, and documenting requirements in requirements documentation and RTM ▪ Manages and coordinates requirements activities ▪ Manages and allocates requirements by maintaining the RTM ▪ Develops requirements specifications ▪ Captures and documents requirements measurements ▪ Participates in requirements estimation activities ▪ Reviews requirements specifications, test plans, test scenarios and high-level design deliverables for accuracy, completeness, and thoroughness ▪ Provides input to project plans and procedures ▪ Identifies risks related to the requirements process ▪ Participates in Quality Assurance (QA) reviews and audits of project activities and work products to ensure compliance with documented plans, procedures, and standards ▪ Reports RM activities and status periodically to the Project Manager
Test Manager	▪ Ensures changes to requirements can be implemented and tested as stated ▪ Validates delivery of requirements by conducting relevant tests
Configuration Management Manager	▪ Baselines the approved documents ▪ Manages changes to configurable items, including requirements
Quality Manager	▪ Reviews Requirements Document, RTM, and other documents supporting RM, as defined in requirements planning documentation ▪ Conducts audits on RM processes and products

Role	Responsibilities
Project Team Member	- Participates in requirements gathering activities - Communicates requirements to the Requirements Manager and participates in documenting requirements - Documents reported Change Requests (CRs) for CCB review - Conducts peer review of Requirements Document and RTM
Project Stakeholders	- Provides input on requirements - Defines project requirements - Participates in user acceptance testing of releases (if system/software that requires testing), to validate appropriate delivery against requirements - Participates in acceptance of requirements NOTE: Reviewers and appropriate stakeholders are identified by the CCB Chair, based on the changes to the product that is under development for a particular release.

4. Procedure

This section presents the process flow for performing requirements management.

4.1   Process Flow Diagram

Figure 4-1 describes the process for RM, which originates with the development of the Requirements Management Plan. The RM process is similar for both new and maintenance tasks. For new tasks, the project should closely follow the RM process to ensure that the requirements baseline is adequate to serve as the basis for the work performed during the project's life cycle. For maintenance updates to work-products, even if the project requirements are already documented, the project should carefully consider each step in the process, even if it does not require significant action.
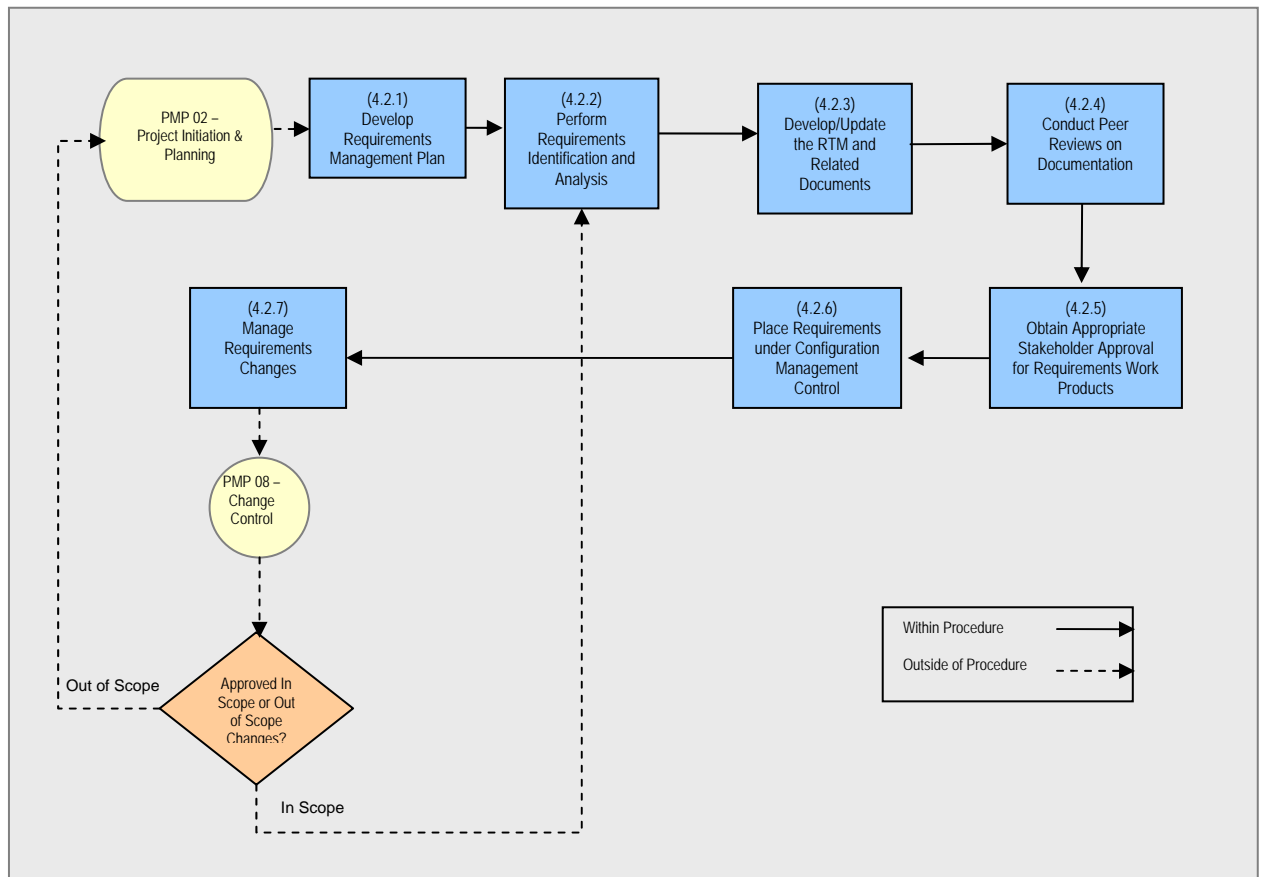

Figure 4-1. RM Process

4.2   Steps

The following sections describe the steps of the requirements management process shown in Figure 4-1 and the roles involved in its execution.

4.2.1   Develop Requirements Management Plan

The purpose of the Requirements Management Plan is to describe the steps the project will follow to define, establish and manage the requirement artifacts (Requirements Documents, Functional Requirements Specifications [FRS], Use Cases, Concept of Operations [CONOPS], etc.,), associated requirement types (User, System, Performance, etc.,), and their respective requirement attributes (ID,

Status, Version, etc.). A Requirements Management Plan also addresses how bidirectional traceability will be managed. See Appendix E for a sample Requirements Management Plan template.

Using the information available in project-defining documents created in the planning phase of the project (see *PMP-02 Project Initiation and Planning Procedure*), the Project Team Lead, the Requirements Manager, and Project Team Members identify the business objectives, scope, and constraints for the project and generate the tasks and estimates associated with the requirements phase. This information serves as the basis for the project and requirements planning and for stakeholder discussions. The Requirements Management Plan also documents assumptions, known risks, and mitigation strategies. For systems projects, the Requirements Management Plan is developed in accordance with OEI's System Life Cycle Management (SLCM) policy and procedures and is incorporated in the System Management Plan (SMP), a document similar to the Project Management Plan.

4.2.1.1   Identify or Revise Requirements Sources

Preparing for the requirements collection process includes identifying individuals with a vested interest in the outcome of the product design (stakeholders) and individuals who can provide insight into potential deliverable uses or development methods (experts or Subject Matter Experts [SMEs]). Legacy systems, policies, and legislation may also serve as requirements sources.

To ensure that the project collects and analyzes the full universe of potential requirements, the Requirements Manager and Project Team Members should collect requirements from a cross-section of stakeholders (i.e., functional users, input providers, output recipients, project officers, and software and system engineers) assigned to implement the requirements. It is also critical to solicit input from a cross-section of geographical locations of both senior and junior staff, as well as customers with different skill levels.

4.2.1.2   Identify the Best Requirement-Gathering Technique

Facilitated workshops, face-to-face interviews, telephone interviews and surveys, mail surveys, screen mock-ups, and prototypes are all useful techniques for collecting requirements. Each technique has its strengths and weaknesses, depending on the specific project. Table 4-1 provides guidance on selecting the appropriate technique(s) for a project environment. Systems projects can employ screen mock up and prototype efforts as appropriate in addition to these other techniques. Employing several data collection techniques allows project teams to balance the weaknesses and strengths of individual techniques and take into account any cost, resource, or schedule constraints. The left column of the table lists factors to consider when selecting a data collection technique. Each row in the table compares and contrasts a factor across different data collection techniques. The Requirements Manager and Project Team Members should gather data in a consistent, thorough, and efficient manner to facilitate the acceptance of customer requirements at the end of the requirements gathering process.

Table 4.1. Examples of Data Collection Techniques

Factor	Facilitated Workshop	Face-to-Face Interview	Telephone Interview/Survey	Mail Survey
Level of Participant Commitment	High ▪ Most effective with small, dedicated teams representative of the user environment	Moderate ▪ Most effective when interview notes are validated in a follow-up session	Moderate to Low ▪ Most effective when interview notes and survey responses are validated before use	Low ▪ Careful selection of participants is a critical success factor
Must Reach Consensus	▪ Most effective since consensus is the goal of the session(s) ▪ Relies on continuity of workshop members	▪ Effective when followed by facilitated workshop to resolve obstacles to consensus ▪ Analysis required	▪ Effective when followed by facilitated workshop to resolve obstacles to consensus ▪ Analysis required	▪ Not suggested when consensus is required ▪ Best used to solicit opinion where decisions are made centrally
Must Integrate Different Perspectives	▪ Most effective opportunity for integration by participants	▪ Integration performed by project analysts	▪ Integration performed by project analysts	▪ Integration performed by project analysts
Project Skills Required	▪ Workshop facilitation	▪ Data gathering ▪ Interview	▪ Communication ▪ Document management	▪ Survey design ▪ Administration
Schedule Considerations	▪ Elicit requirements from the most people in the shortest time frame	▪ Cancellations and changes to interview schedule can impact project schedule	▪ Unpredictable schedule due to stakeholder availability (e.g., telephone tag)	▪ Unpredictable because it depends on timely response
Travel Considerations	▪ Geographically diverse stakeholders may involve travel by the stakeholders	▪ Geographically diverse stakeholders may involve travel by the team	▪ Follow-up workshop may require travel by stakeholders	▪ None
Quality of Information	High	High to Moderate	Moderate to Low	Low
Level of Detail	Low	Moderate	Moderate	High

4.2.2   *Perform Requirements Identification and Analysis*

The Requirements Manager and Project Team Members create and/or update requirements documentation as requirements are identified or gathered, to include high-level models (node tree, context, and entity relationship diagrams, etc., used in IT-projects), interview notes, workshop and meeting minutes, and survey results. These documents provide the basis for understanding the expectations of the project's requirements and help in the process of achieving clarification, consensus, and commitment on requirements among Project Stakeholders and the project team.

After gathering requirements from stakeholders, SMEs, and any other potential sources, including any legacy system re-engineering (for IT projects), analysis of these customer requirements allows the

Requirements Manager to evaluate and refine them against the project's business objectives, scope, and constraints. This analysis may uncover requirements that do not fit within the intended scope of the work product being created or that are incomplete or missing. Such issues require resolution at this early stage, as these requirements form the basis for all subsequent software development or project delivery activities and may affect stakeholders' acceptance of the product.

Note: The Requirements Manager and the appropriate Project Team Members expected to build the final product or deliver services should participate in the requirements definition and validation with the appropriate stakeholders to ensure requirements are clear and concise, measurable, achievable, realistic, consistent with the other requirements, and testable.

The Requirements Manager and the Project Team Members then categorize the requirements and for IT projects, allocate them to systems (e.g., functional, interface, performance) and non-systems components (e.g., manual component, policy). The following is a descriptive list of some possible categories and supporting sub-categories of IT requirements:

- **Feature Requirements:** Indicates all feature requirements for the project. Keyword: customer, provide, prevent, publish, prompt, and limit.

- **Reporting Requirements:** Describes the characteristics of each standard report, including the report title, purpose, format, data attributes, sorts, filters, calculations, and targeted audience.

- **System Requirements.** Indicates all system requirements for the project. Keyword: determine, display, allow, accept, and verify.

- **Human Engineering (Ergonomic) Requirements:** Describes the system specifications that support the ease of operation, in particular a uniform operating environment for all tools and products.

- **Data Requirements:** Describes the business information needed, including data elements by name, type, and format. This results in a high-level data model, which outlines dictionaries, tables, and reference files.

- **Hardware Requirements:** Describes hardware requirements.

- **Capacity Requirements:** Describes the hardware infrastructure and includes computer memory, disk storage space, and printer throughput.

- **Technical Architecture Requirements:** Describes the minimum configuration and capabilities required, categorized by headquarter workstations, remote workstations, printers, and database, Web, and remote access servers.

- **Special Requirements:** Describes requirements that support the project's mission including training, transition processing, data conversion, and testing.

- **Performance Requirements:** Describes performance issues such as sizing, backing up, restarting, restoring, accuracy, transaction volumes and timing, flexibility, reliability, availability, and maintainability.

- **Security Requirements:** Describes the measures that must be taken to protect system configuration and data.

The Requirements Manager along with appropriate Project Team Members must ensure requirements are:

- Clear and concise
- Feasible and appropriate to implement for development

- Consistent with the other requirements and non-redundant
- Testable
- Complete
- Unambiguous.

Requirements identification and analysis are important activities that are often difficult to implement effectively. Appendix C provides resources to consult when developing requirements. Appendix F provides a list of common problems detected during the requirements analysis phase and ways to solve them or minimize their impact.

4.2.3   Develop/Update the Requirements Traceability Matrix (RTM) and Related Documents

After the team assembles and categorizes the requirements, the Requirements Manager creates the RTM. The RTM serves as the basis for all project RM activities. Project teams use an RTM (automated or manual) to record the traceability of each requirement. Every item in the RTM must first be uniquely identified. During the early stages of a project, the Requirements Manager works with the Project Manager, Team Lead, and Configuration Manager to define the items the project RTM will track. Traceability analysis should be repeated throughout the product life cycle. The goals of traceability analysis are to validate that the design meets the requirements, to verify that the requirements are tested, and to ensure that the project addresses all requirements. Refer to Appendix G for an RTM template and sample.

In addition to the RTM, the Requirements Manager ensures other related documents are also created and updated, as specified in the Requirements Management Plan. These additional documents describe requirements in further detail to allow for a greater understanding of the requirements by all relevant stakeholders, to include contractors and quality control activities.

For system projects, the requirements documents must provide the stakeholders and the Project Team with adequate detail in the description of requirements to be approved/rejected, implemented, and to support requirements traceability through the design, development, and testing phases.

The Project Team Lead reviews the project's Requirements Document and works with the Project Team and the Project Manager to ensure that it will meet the project's specific needs.

4.2.4   Conduct Peer Reviews on Documentation

Peer reviews of requirements work products should include, when possible, representation from the functional analysts and testers (for IT projects) to ensure that all affected groups are able to provide feedback regarding the Requirements Document and RTM. Other groups should be included as necessary. Feedback from the peer review should be incorporated.

Four types of requirements reviews should occur during the course of a project:

- Peer Reviews – Participants in these peer reviews include functional analysts, developers, testers, process area leads, and technical managers where appropriate (for IT projects).
- Project Manager – The Project Manager reviews the activities associated with RM on both a periodic and event-driven basis.
- Quality Manager – The Quality Manager reviews and/or audits the activities and work products for managing the allocated requirements and reports the results, according to the project's Quality Assurance Plan or contractor's Quality Assurance Surveillance Plan (QASP).

See *PMP-09 Quality Management Procedure* for more information about development of the Quality Assurance Plan, quality assurance reviews, and audits.

▪ CCB Reviews – This established forum conducts reviews for new requirement acceptance or modifications to requirements. See *PMP-08 Change Control Procedure* for more information about the operation of the CCB.

Once the project's requirements documents are updated as a result of peer reviews, the Requirements Manager provides the document(s) to the Project Team Leads and Project Manager for approval prior to obtaining customer approval.

4.2.5   Obtain Appropriate Stakeholder Approval for Requirements Work Products

Successful RM includes approval and baselining of the requirements. Requirements approval refers to the customer's acceptance of the list of requirements. Methods used to obtain customer approval include:

▪ Customer signatures

▪ CCB meetings

▪ E-mail notification.

Requirements baselining occurs after customer approval. Baselining refers to the point in time after which the project team may not incorporate any requirement change without going through the project's change control process (See *OETI-PMP 08 Change Control Procedure* for details).

Each Project Team is responsible for the formal documentation of the acceptance process.

4.2.6   Place Requirements under Configuration Management Control

The Requirements Manager works with the project's Configuration Management Team to ensure that the baselined requirements work products are placed under appropriate configuration control for the duration of the project.

4.2.7   Manage Requirements Changes

Prior to the establishment of the requirements baseline, the Requirements Manager manages changes to the requirements, updating the RTM and any other requirements documentation as changes occur. After requirements are baselined, the Requirements Manager participates in on-going requirements analysis and product design meetings to identify and collect potential changes to the requirements baseline. Changes to an approved requirements baseline are initiated via a Change Request (CR), which is a part of the Change Control process (see *PMP-08 Change Control Procedure)*. In proposing changes to the requirements baseline, three types of changes are possible:

▪ **Requirement Addition:** Indicates that the project develops a new feature to support a business process or address an area that is not currently in scope or supported. It could also indicate the addition of new functionality to an existing application. The customer community initiates requirements for new system or product development and passes them to the development team via the customer or CCB.

▪ **Requirement Modification:** Specifies either modifications of or corrections to existing functionality or data. Internal testing, customer/user requests, or CCB decisions may initiate these modifications.

- ▪ **Requirement Deletion:** Indicates that the requirement is no longer essential to the product. Based on the Team Lead or the customer's request, the CCB reviews the requirement that may be nonessential and decides whether to delete the requirement.

The Requirements Manager enters approved changes into the RTM to maintain a history of requirement changes. Refer to the *PMP-08 Change Control Procedure* for a description of change control, determining the impact of a potential requirements change, and the role of the CCB in addressing CRs.

5. Considerations

The following provides a list of general best practices that should be considered when conducting requirements management activities:

- The involved participation of stakeholders is critical to successful requirements management. Depending on the nature of the project, they should be active partners in identifying, discussing, and documenting the requirements.

- Approach requirements management as a negotiation process. It is very unlikely that the project team and the stakeholders will agree on all requirements. However, to keep the process collaborative and manageable, seemingly unreasonable requirements should be neither accepted nor rejected outright by the project team.

- Prioritizing requirements allows for more efficient application of project resources. This should be done by the stakeholders, as they will be most affected by the outcome.

- While it is important to baseline requirements early in the project, ensure that stakeholders are not prevented from suggesting necessary requirements changes by a cumbersome change control process. This can also prevent the inclusion of gratuitous requirements in the initial baseline, as stakeholders who believe they cannot make changes later on will often err on the side of excess in the initial phase.

- Documentation of requirements is essential, but remember that the goal is, ultimately, to implement them. Try to create a documentation process that balances the benefits of both traceability and flexibility.

Appendix A   Acronyms

The following acronyms shown below are referenced in this document.

Abbreviation	Description
BFM	Budget Formulation
BRM	Business Reference Model
BXC	Budget Execution
CCB	Change Control Board
CMMI	Capability Maturity Model Integration
CONOPS	Concepts of Operation
CR	Change Request
DO	Delivery Order
EPA	Environmental Protection Agency
FRS	Functional Requirements Specification
FSIO	Financial Systems Integration Office
ID	Identification
IT	Information Technology
OEI	Office of Environmental Information
OETI	Office of Enterprise Technology and Innovation
PAY	Payment Management
PMBOK®	Project Management Body of Knowledge
PMI	Project Management Institute
QA	Quality Assurance
QASP	Quality Assurance Surveillance Plan
RM	Requirements Management
RTM	Requirements Traceability Matrix
SEI	Software Engineering Institute
SLCM	System Life Cycle Management
SME	Subject Matter Expert
SMP	System Management Plan
TO	Task Order
WA	Work Authorization

Appendix B   Requirements Management Checklist

The following provides a checklist for the key activities associated with each step of this RM procedure.

Activities	Responsible Parties
4.2.1 Develop Requirements Management Plan	
❑ Description of how requirements artifacts (requirements documents, Use Cases, Concept of Operations, etc.) will be developed and managed during the project life cycle is provided	Requirements Manager
❑ Description of how requirement identification and analysis will be accomplished (e.g., sources, types, attributes, techniques, tools, etc.) is provided	
❑ The method by which bi-directional traceability will be established and maintained is described	
❑ RM template is leveraged/referenced	
❑ Tasks and estimates are planned for the requirements phase	Project Manager, Requirements Manager
❑ Business objectives, scope, and constraints are described for the project	
❑ Assumptions, known risks, and mitigation strategies are identified and addressed, if appropriate	
4.2.2 Perform Requirements Identification and Analysis	
❑ Requirements gathering, identification, and analysis activities are done according to what is stated in the Requirements Management Plan	Requirements Manager
❑ Documentation is created and/or updated according to Requirements Management Plan	
❑ Requirements are identified, gathered, defined, and validated with the appropriate stakeholders to ensure they are clear and concise, measurable, achievable, realistic, consistent with the other requirements, and testable	Requirements Manager, Project Team
❑ Requirements are categorized and, for IT projects, are allocated to systems (e.g., functional, interface, performance), and non-systems components (e.g., manual component, policy)	
4.2.3 Develop/Update the RTM and Related Documents	
❑ The RTM is developed/updated with the newly created/modified requirements	Requirements Manager
❑ Related requirements documents are developed/updated with the newly created/modified requirements and detailed descriptions, including any additional analysis	
❑ Traceability is conducted throughout the life cycle	Requirements Manager, Project Team Leads, Project Team
❑ Requirements documents contain enough information for the stakeholder to understand, approve, or reject the documented requirements	Requirements Manager, Project Manager, Project Team Leads
❑ Requirements documents are developed sufficiently to meet the project's specific needs	
4.2.4 Conduct Peer Reviews on Documentation	
❑ Requirements documents/artifacts (e.g., RTM) are reviewed and modified as necessary before being sharing with project stakeholders	Requirements Manager, Project Team Leads, Project Team, QA Manager, Project Manager, Test Team
4.2.5 Obtain Appropriate Stakeholder Approval for Requirements Work Products	

Activities	Responsible Parties
❑ Approval solicitation method is employed (i.e., CCB, facilitated walk through, etc.) ❑ Stakeholder approval is obtained for requirements work products (RTM and Requirements Document, in most cases)	Project Stakeholders
4.2.6 Place Requirements under Configuration Management Control	
❑ Approved requirements work products are placed under Configuration Management control	Configuration Management Team, Requirements Manager
4.2.7 Manage Requirements Changes	
❑ Changes to the requirements baseline have gone through the Change Control process (Refer to O*ETI-PMP 08 Change Control Procedure* for a description of change control)	Project Manager, Project Stakeholders, Requirements Manager, Configuration Management Team
❑ Requirements documentation (e.g., RTM) is updated to reflect approved changes	Requirements Manager

Appendix C   Additional Resources

The following provides a list of key resources and references associated with the requirements management procedure that can be used to assist in completion of the activities.

	Form/ Guidance	Source	Website
1.	Guidance for Management of Systems Projects	Center for Systems Management. *Course: Requirements Development.* Virginia: Center for Systems Management, Inc., 2004.	NA
		Andrew Stellman and Jennifer Greene (2005). *Applied Software Project Management* Cambridge, MA: O'Reilly Media. ISBN 0-596-00948-8.	http://www.stellman-greene.com/aspm/
		McConnell, Steve (1996). *Rapid Development: Taming Wild Software Schedules*, 1st ed., Redmond, WA: Microsoft Press.	http://www.stevemcconnell.com/
2.	Guidance for Systems Engineering Activities	Eisner, Howard. Essentials of Project and Systems Engineering Management Second Edition. New York: John Wiley & Sons, Inc., 2002.	NA
		Stevens, Richard; Brook, Peter; Jackson, Ken; Arnold, Stuart. *Systems Engineering Coping with Complexity.* Great Britain: Pearson Education, Limited, 1998.	NA
3.	Guidance on Writing Requirements	Le Vie, Jr., Donn. Writing Software Requirements.	http://www.techwr-l.com/techwhirl/magazine/writing/softwarerequirementspecs.html
		IEEE Std 830-1993, Recommended Practice for Software Requirements Specifications, December 2, 1993.	NA
4.	Guidance on Effective Requirements Management	Gause, Donald C., and Weinberg, Gerald M., Exploring Requirements Quality Before Design, Dorset House Publishing, NY, NY, 1989.	NA
		Wiegers, Karl E. (2003). *Software Requirements 2: Practical techniques for gathering and managing requirements throughout the product development cycle* 2nd ed., Redmond: Microsoft Press. ISBN 0-7356-1879-8.	http://www.processimpact.com/
		Wiegers, Karl E. Software Requirements, Microsoft Press, Redmond, WA, 1999.	NA

Appendix D   Interface Requirements

The purpose of this appendix is to provide general guidelines for collecting the appropriate information from contractors to ensure seamless integration of project data and promote efficient monitoring of the overall project. Frequently, data is needed by support contractors to enable the Project Manager to accurately assess real-time status against overall performance, schedule and cost objectives. In addition, the interface points among the different parties, both government and contractor, need to be fully delineated with regard to requirements management to ensure that each party understands their specific role and responsibility in data management and reporting and that the information can be efficiently captured utilizing the project's established management processes and tools. As a result these data, reporting, and interface requirements need to be well defined early in the process in order to ensure that they are fully delineated in the awarded contract, Work Authorization (WA), Delivery Order (DO), and/or Task Order (TO). In addition, the frequency, format, and mode of submission for the different reporting requirements also need to be defined within the contract or WA, DO, or TO.

The following series of questions is provided to help determine the data, reporting and interface requirements that may be required for requirements management activities for a specific project. Requirements may vary significantly depending on the scope, complexity, size, duration and of the project and type of contracts awarded. Overall the questions are designed to help refine what kind of information will be needed to ensure effective management of the requirements process, the project and the correlating responsibilities of the contractor.

- Will the contractor be involved in gathering or analyzing requirements?
  - What level of detail is needed for capturing requirements?
  - What types of requirements will be captured?
  - Which groups of customers or stakeholders will the contractor need to work with in order to gather/define requirements?
  - What kind of format will the contractor need to properly document requirements?
  - What tools (if any) will the contractor be required to interface with or provide data to for the documentation of requirements?
  - Will the contractor be performing a fit-gap analysis or some other type of evaluation to determine how requirements will be met by the product or deliverable?
- Will the contractor be responsible for maintaining or demonstrating requirements traceability?
  - Will the contractor need access to the baselined requirements to perform other work (such as design or testing)?
  - Will contractor deliverables need to reflect requirements traceability?
  - Are performance measures defined for the contractor based on how well their product or deliverable meets defined requirements?
- Will the contractor be allowed or required to identify new requirements through the change control process?

Appendix E   Requirements Management Plan Template

This appendix provides a sample Requirements Management Plan template that may be used and/or tailored as appropriate according to project needs.

Requirements Management Plan Template

Acceptance/Approval Page

DOCUMENT CHANGE HISTORY – *Complete the version, date, author and description column to accurately describe the modifications made to this document.*

Version	Date	Author	Description of Changes
V X.X			

1.0   INTRODUCTION

[This section introduces the document. Additional information may be added that describes the project background or description, and any specific policies or procedures. Example: This RM Plan is the controlling document for developing and managing the requirements for the <Project Name> project.]

1.1   PURPOSE

[This section defines the purpose of the plan. Additional information may be added to further clarify the purpose of the document. Example: This document describes the guidelines used by the <Project Name> project for establishing the requirement document, requirement types, requirement attributes, and traceability in order to manage their software project requirements.]

1.2   SCOPE

 [This section defines the parameters of the requirements management plan. Add any text necessary to define what is included and what is excluded as part of the scope of the plan. This text may:

- Name the specific entity, product, project team, and/ or component for which requirements management activities are performed and those that are expressly excluded
- Define whether this plan will document creation of an initial baseline of requirements for new development, or whether it will define requirements management for maintenance of existing requirements
- Identify if contractor support is used on the project and if they will be the subject of quality assurance activities
- Describe other boundaries for the plan]

1.3   REFERENCE DOCUMENTATION

[This section identifies the references, standards, procedures and other documents used to develop the RM activities for the project. This list may include:

- <project name> Project Management Plan
- <project name> Project Schedule
- <project name> Configuration Management Plan
- <project name> Configuration Item/Configuration Data List

- <project name> Risk Management Plan
- <project name> Statement of Work and/or Contract and/or Applicable Contractual Requirements
- Other project documentation, as necessary
- Internal or external requirements management resources or standards, as applicable. For system projects, the Requirements Manager should refer to the Office of Environmental Information's System Life Cycle Management Policy and corresponding procedures when developing the requirements management plan.]

1.4   PLAN MAINTENANCE

[This section identifies the office or group responsible for developing, maintaining, and distributing this plan. It also establishes how often the plan is reviewed, typically by organizational directives. Updates are prepared as required.]

2.0   REQUIREMENTS MANAGEMENT

[This section is used to document some overview information about the requirements management process.]

2.1   ROLES & RESPONSIBILITIES

[This section is used to describe the Requirements Management (RM) group, their responsibilities, and interfaces with other groups. Enter the responsibilities of the RM group members. Refer to or insert an Organization Chart and any inter-group interfaces. Example: The RM group consists of the project's RM Manager and the RM Analyst(s), if assigned. Responsibilities for the RM group are defined in Table 2-1 (insert table with detailed responsibilities).]

2.2   TOOLS, ENVIRONMENT AND INFRASTRUCTURE

[This section is used to document appropriate RM tool information. Add additional sentences or paragraphs, as needed, to further clarify the tools, environment, and infrastructure for RM.]

3.0   THE REQUIREMENTS MANAGEMENT PROGRAM

3.1   REQUIREMENTS IDENTIFICATION

[Every item in a requirement traceability matrix must be uniquely identified. This section defines how items are identified. Requirements gathering techniques that will be used on the project are identified here. Requirements providers are also identified here.]

3.1.1   ATTRIBUTES

[This section is used to list and describe attributes which will be associated with each requirement. Attributes may be useful in tracking requirements through the life cycle of a project. Examples of attributes include: Title, Description, Status, Category, Priority, Assigned To, Type, Impact, Release, Reported By, etc.]

3.2   REQUIREMENTS ANALYSIS

[This section is used to describe how a project will analyze and categorize requirements once they have been gathered. Document the requirements analysis procedures and methods the project follows to determine if the requirements are sufficient to meet the project stakeholder objectives for the product. Some examples of possible requirements analysis activities to describe are: the process for analyzing stakeholder needs and expectations, review and analysis of functional groupings of requirements, the utilization of use case diagrams or activity flows. Be sure to address stakeholder needs and constraints such as cost, schedule, performance, maintainability, or risk during requirements analysis. Requirements (and changes to requirements) should be analyzed in the context of the constraints imposed by project costs, schedule, performance parameters and goals, and risks. Technical and considerations such as functionality, reusable components, and maintainability should also be considered when analyzing requirements as well.]

3.3   REQUIREMENTS TRACKING & TRACEABILITY

[This section is used to describe bidirectional traceability and use of a Requirements Traceability Matrix. The RTM cross references the change requests, design document, test scripts, and other meaningful data.]

3.4   REPORTS AND MEASURES (if applicable)

[This section is used to document reporting activities for RM, as well as information regarding the collection and analysis of RM measures. If the information is already contained in other documents, those documents can be referenced, instead of repeating the information.]

3.5   REQUIREMENTS VALIDATION

[This section is used to document the Validation Requirements process for analysis as requirements may need to be modified. The requirement(s) must be validated to ensure that the correct product is being produced to meet the stakeholders' needs. Examples of validation include prototyping, requirements documents, and meeting minutes. The requirement(s) for validation must be prepared. This preparation may include any supporting work products or activities such as review meetings with the client, prototyping, etc. Stakeholder feedback is to be collected and documented. An analysis of the collected feedback is completed, and requirements are to be modified based on the analysis of the validation feedback. Formal requirements validation processes can be further documented in the Test Plan, if in fact the Test Plan is applicable and more appropriate.]

3.6   REQUIREMENTS CHANGE CONTROL

[This section should reference the project's Change Control process or charter. Add additional sentences or paragraphs, as needed, to describe the change control process.]

3.7   WORKFLOW AND ACTIVITIES

[This section is used to describe the requirements management workflow and activities.]

4.0   MILESTONES

[This section is used to identify the internal and customer milestones related to the RM effort. This section should also include details on when the RM Plan itself is to be updated.]

5.0   TRAINING AND RESOURCES

[This section should be used to describe the software tools, personnel, and training required to implement the specified RM activities.]

APPENDIX A - **ACRONYMS**

APPENDIX B - **DEFINITIONS**

Appendix F   Common Requirements Problems and Solutions

Table F-1 provides a list of common problems detected during the requirements analysis phase and ways to solve them or minimize their impact.

Table F-1. Common Requirements Problems and Potential Solutions

Problem	Potential Solution
Frequently changing requirements and/or difficulty in getting the appropriate stakeholders approval and sign-off	▪ Implement prototyping and Joint Application Development sessions to assist the appropriate stakeholders in finalizing the requirements
	▪ Describe the impact of a changed or added requirement to the project
Some requirements remain difficult to define or are initially unknown	▪ Select a more flexible life cycle model that supports changing requirements.
The feasibility of one or more individual requirements may be in question	▪ Implement prototyping, involve experts to perform a feasibility analysis, or require approval for alternative requirements if the original is not feasible
Typical end-users are not involved - Users need to be involved in defining, reviewing, and approving the requirements. If this critical step is missing, there is a high risk that the product will not meet their needs and expectations	▪ Good sources of user input include user groups, advisory councils, and specific engineers at customer facilities who may later participate in acceptance testing
Usability attributes are not defined	Identify potential usability attributes, which may include: ▪ Easy installation ▪ Consistent and logical user interface ▪ Use of standard Windows user interface conventions ▪ Complete and accurate documentation ▪ Useful on-line help ▪ Clear error messages that direct the user to a solution ▪ Performance requirements (system response times) ▪ Adequate technical support

Appendix G   Requirements Traceability Matrix Template

This appendix provides a sample RTM template that may be used and/or tailored as appropriate according to project needs. A sample RTM used for an OETI systems project is also provided.

G.1   RTM Template

Below is a generic RTM template which covers the basic elements of tracing requirements throughout a project's life cycle. This would be the minimum set of criteria an RTM should have; however, more columns may be added provided they match the attributes specified in the RM Plan. All RTMs should have an explanation of the table headers at the beginning of the document so an understanding can be developed between the author and the reader. Bi-directional traceability should also be explained suggesting that traceability will not only be demonstrated here but in the work products that are a result of these requirements.

Traceability is a key activity in the system life cycle to ensure that requirements have been addressed in the various work products produced by the life cycle phases. The RTM is the tool used in maintaining traceability for the project. It shows traceability from the initial change request all the way through implementation. To ensure accurate and complete development of the change requests, requirements are traced through all phases of the life cycle. The artifacts produced by the life cycle phases must also trace back to the requirements by including the requirements ID in the comments or text. The RTM is also an important tool as it tracks which requirements are addressed in the initial implementation and which will be deferred to a later release.

There are ten columns in the RTM, which are described as follows:

- Requirement ID – Displays the historical ID number for each requirement
- CR – Indicates any associated CR initially assigned to each requirement
- Requirement Name– Provides a brief title for the requirement
- Requirement Description – Contains a brief description of the requirement
- Status – Identifies the status of the requirement as it relates to the development phase
- Requirement Type – Identifies the type (i.e., Business, Functional, Ergonomic, Software, User, System) of requirement in the implementation process
- Version – Identifies the version release in which the requirement was incorporated. A blank space suggests that the requirement has not been satisfied in the software to date.
- Trace to Design – Indicates the design document that contains design information for the requirement
- Trace to Develop – Indicates the code/product where the requirement is implemented
- Trace to Test – Indicates the test script used to test the requirement.

Requirement ID	CR	Requirement Name	Requirement Description	Status	Requirement Type	Version	Trace to Design	Trace to Develop	Trace to Test
Requirement ID #			Detailed Requirement				Name of Design Document	Name of Code/Product	Name of Test Script

G.2   Sample RTM

This section provides an example of an RTM used for an OETI systems project. The project team tailored the template from section G.1 in order to best meet project needs.

The following spreadsheets provide additional details regarding the requirements. These spreadsheets will facilitate review and research by providing users with the ability to filter, sort, and manipulate fields as required.

The following information is provided:

- Type – The type of function the requirement refers to (e.g., BXC is Budget Execution, PAY is Payment Management, etc)

- Requirement Number (Req. No.) – Provides a unique identifier for each requirement. Requirement numbers with a Financial Systems Integration Office (FSIO) designation refer to FSIO mandatory requirements; those with an EPA designation refer to FSIO value-added requirements or EPA-originating requirements

- Source – Identifies the original source of the requirement

- Requirement Description – Provides the original wording of the requirement as was presented in the Focus Group read-ahead packet

- Priority – Provides the priority designation of Mandatory, High Value Added, Medium Value Added and Low Value Added. At this time priorities have only been assigned for FSIO mandatory requirements and a few requirements for which the focus group specified priority. Analysis will be conducted to determine the range of priority numbers that will comprise the priority designations (e.g., 3.4 – 4.0 indicates Mandatory). Once the analysis has been performed, priorities will be assigned to each requirement.

- Related FSIO Number – Provides the associated FSIO requirement number

- BRM Ref # (Main) – Indicates the main business reference model number that the requirement is associated with. This field can be used for sorting and formatting

- BRM Ref # (All)– Indicates all of the business reference model numbers that the requirement is associated with

- BRM Ref Name – Indicates the name of the business reference model grouping that the requirement is associated with.

- FSIO Class. Name – Indicates the classification of the requirement as designated by FSIO

- ▪ Rationale - Indicates the justification for the requested requirement. Rationales for functional requirements include Supports EPA Strategic Plan, Core Business Function, Government Regulation, Political Requirement, Stakeholder Requirement or Not Relevant. Rationales for technical requirements include EPA IT Strategic Standards, Government Regulations, Technology Developments, Pending Legislation or Court Decisions
- ▪ Relevance - For FSIO mandatory requirements, identifies the level of relevance to EPA's business as High, Medium or Low.

Type	Req. No.	Source	Requirement Description	Priority	Related FSIO Number	BRM Ref# (Main)	BRM Ref # (All)	BRM Ref Name	FSIO Class. Name	Rationale	Relevance
BFM	BFM-EPA-001	EPA	Define and maintain relationships between budgetary structures, accounting structures, and organizational structures	Mandatory	N/A	3.8.1.1	3.8.1.1	Issue Guidance	Annual Resource Planning	Core Business Function	N/A
BFM	BFM-EPA-002	EPA	Capture and maintain validation tables for any budget line item or data element in the budget structure	Mandatory	N/A	3.8.1.1	3.8.1.1	Issue Guidance	Annual Resource Planning	Core Business Function	N/A
BFM	BFM-EPA-003	EPA	Provide access to electronically linked budget guidance and narrative (EPA Budget Manuals and Directives, budget call, strategic plans and guidance, etc.,) without audit trails for budget-related electronic documents.	Value Added High	N/A	3.8.1.1	3.8.1.1	Issue Guidance	Annual Resource Planning	Core Business Function	N/A
BFM	BFM-EPA-004	EPA	Ability to relate "metadata" (e.g., congressional mandates, regulatory requirements, etc.,) to any level of the strategic plan	Value Added High	N/A	3.8.1.1	3.8.1.1	Issue Guidance	Strategic Perf. Planning	Core Business Function	N/A